Claims

What is claimed is:

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1. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

calculating a first quantizer step size such that a first number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a first given number of frames starting at a current frame;

incrementing the current frame; and

calculating a second quantizer step size such that a second number of bits generated at the output of the constant-bit-rate finite-buffer-size video encoder is constant over a second given number of frames starting at the incremented current frame.

2. The method of claim 1 wherein the step of calculating the second quantizer step size further comprises the step of:

using a second given number of frames that is equal to the first given number of frames.

3. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of::

calculating a power value for a first frame;

adjusting a number of bits in a second frame based on the power value for the first frame.

4. The method of claim 3 wherein the step of calculating the power value for the first frame further comprises the steps of:

calculating an average value of the pixel values in each of a plurality of pixel blocks within the first frame;

for each of the plurality of pixel blocks, calculating a sum of absolute differences between the pixel values in the respective pixel block and the average value;

adding each sum of the absolute differences for each of the plurality of pixel blocks within the first frame to obtain a power value for the first frame.

5. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

calculating a reference global complexity for each I frame encoded;

calculating a reference power value for each I frame encoded;

calculating a power value for subsequent frames;

calculating a global complexity by multiplying the reference global complexity by the power value and dividing by the reference power value;

using the global complexity to adjust a frame size.

6. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

obtaining a prediction error frame including a plurality of pixel-level error values;

calculating a sum of absolute values of the pixel-level error values for a pixel block;

calculating an expected number of bits for the pixel block based on the sum of the absolute values, and

using the expected number of bits for the pixel block to obtain constant-bit-rate video encoding.

7. The method of claim 6 wherein the step of using the expected number of bits for the pixel block to obtain constant-bit-rate video encoding further comprises the steps of:

calculating an expected number of bits for a frame in which the pixel block is located; and

using the expected number of bits for the frame to obtain constant-bit-rate video encoding.

8. The method of claim 7 wherein the step of calculating the expected number of bits for the frame further comprises the step of:

summing the expected number of bits for the pixel block for all pixel blocks in the frame.

9. The method of claim 7 wherein the step of calculating the expected number of bits for the pixel block further comprises the step of:

for each pixel block in the frame, multiplying a pixel block complexity value by the sum of the absolute values of the pixel-level error values for the pixel block and dividing by a target quantizer step size for the frame.

10. The method of claim 9 wherein the step of calculating the expected number of bits for the frame further comprises the step of:

summing the expected number of bits for the pixel block for all pixel blocks in the frame.

11. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

predicting a relationship between a quantizer scale factor and a number of encoded bits of a pixel block based on a known relationship in previous pixel blocks of a same type; and

using the quantizer scale factor to control a pixel block level rate of the video encoder.

12. The method of claim 11 wherein the step of using the quantizer scale factor to control the pixel block level rate of the video encoder further comprises the step of:

using the quantizer scale factor together with a sum of absolute values of pixel-level error values to control the pixel block level rate of the video encoder.

13. The method of claim 11 wherein the step of predicting the relationship between the quantizer scale factor and the number of encoded bits of the pixel block further comprises the steps of:

predicting a first relationship between the quantizer scale factor and a first number of encoded bits of a first type of pixel block based on a first known relationship in previous pixel blocks of the first type; and

predicting a second relationship between the quantizer scale factor and a second number of encoded bits of a second type of pixel block based on a second known relationship in previous pixel blocks of the second type.

14. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

calculating a prediction for a number of bits encoded for a pixel block based on a sum of absolute values of pixel-level error values, a pixel block complexity, and a quantizer scale factor;

using the prediction for adjusting the quantizer scale factor to meet a targeted picture-level number of bits.

15. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

calculating a group-of-pictures-level prediction for a number of bits encoded for a group of pictures;

calculating a picture-level prediction for a number of bits encoded for a picture;

calculating a pixel-block-level prediction for a number of bits encoded for a pixel block; and

using the group-of-pictures-level prediction, the picture-level prediction, and the pixel-block-level prediction to adjust a quantizer scale factor to provide the rate control for the video encoder.

16. The method of claim 15 wherein the step of calculating the picture-level prediction for the number of bits encoded for the picture further comprises the step of:

calculating the picture-level prediction for the number of bits encoded for the picture based on a pixel block type, a sum of absolute values of pixel-level error values, and a pixel block complexity.

17. The method of claim 15 wherein the step of calculating the pixel-block-level prediction for the number of bits encoded for the pixel block further comprises the step of:

calculating the pixel-block-level prediction for the number of bits encoded for the pixel block based on a local activity value.

18. The method of claim 15 wherein the step of calculating the group-of-pictures-level prediction for the number of bits encoded for the group of pictures further comprises the step of:

calculating the group-of-pictures-level prediction for the number of bits encoded for the group-of-pictures based on a global complexity value.

19. A method for rate control for a constant-bit-rate finite-buffer-size video encoder comprising the steps of:

obtaining a scene change indication from a prediction error image; and

using the scene change indication to reset a global complexity history; and

using the global complexity history to provide the rate control for the video encoder.

20. The method of claim 19 wherein the step of obtaining the scene change indication from the prediction error image further comprises the steps of:

counting a first number of intra coded pixel block in the prediction error image;

counting a second number of non-intra coded pixel block in the prediction error image;

calculating a ratio of the first number and the second number;

comparing the ratio to a threshold to determine a result; and

using the result as a scene change indication.

21. Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a preprocessing stage for determining a power value; and

a group-of-pictures-level rate control block operatively coupled to the preprocessing stage to receive the power value and to provide a target quantizer step size used to provide rate control for the video encoder.

22. The apparatus of claim 21 wherein the preprocessing stage updates the power value for each subsequent picture being encoded.

23. The apparatus of claim 21 wherein the group-of-pictures-level rate control block causes an adjustment of sizes of non-intra frames based on expected sizes of future intra frames.

24. Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a prediction error image block to determine L1 distances according to sums of absolute differences;

a picture-level rate control block operatively coupled to the prediction error image block to receive the L1 distances and to produce a target quantizer step size for a pixel block.

25. The apparatus of claim 24 further comprising:

a complexity estimator block coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values.

26. The apparatus of claim 25 wherein the prediction error image block determines a scene change and provides a scene change indication to the complexity estimator block, the complexity estimator resetting a global complexity value upon receipt of the scene change indication.

27. Apparatus for rate control for a constant-bit-rate finite-buffer-size video encoder comprising:

a prediction error image block to determine L1 distances according to sums of absolute differences;

a complexity estimator block coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values.

a number-of-bit predictor operatively coupled to the prediction error image block to receive the L1 distances and to the complexity estimator block to receive the non-intra pixel block complexity values and the intra pixel block complexity values, the number-of-bit predictor to predict a number of bits generated by the video encoder.